MVE

Monitoring, Verification, and Evaluation (MVE) Unit
of the Egyptian Environmental Policy Program

Evaluation Analyses

DRAFT FINAL REPORT

Towards a Common Information Base For Egyptian Red Sea Protection and Development

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List of Acronyms

CAPMAS	Central Agency for Public Mobilization and Statistics
CRI	Coastal Research Institute, National Water Research Center, Ministry of Water Resources & Irrigation
EEAA	Egyptian Environmental Affairs Agency
EEPP	Egyptian Environmental Policy Program
EIA	Environmental Impact Assessment
EIMP	Environmental Information and Monitoring Program/EEAA
EST	Environmentally Sustainable Tourism project
FGDC	Federal Geographic Data center – USA
GAPS	General Authority for Protection of Shores
GCRMN	Global Coral Reef Monitoring Network
ICRI	International Coral Reef Initiative
ISO	International Organization for Standardization
GEF	Global Environmental Facility
GIS	Geographic Information System
GOPP	General Organization for Physical Planning
ICRI	International Coral Reef Institute
MVE	Monitoring, Verification, and Evaluation (EEPP)
NARSS	National Authority for Remote Sensing and Space Sciences
NBU	National Biodiversity Unit/NPD/EEAA
NCDCNH	National Center for Documentation of Cultural and Natural Heritage – Ministry of Communication and Information
NCICZM	National Committee for Integrated Coastal Zones Management
NEAP	National Environmental Action Plan
NIOF	National Institute for Oceanography and Fisheries
NGO	Non-Governmental Organizations
NPD	Nature Protection Department
RAP	Rapid Assessment Program
REA	Rapid Ecological Assessment
RSG	Red Sea Governorate
TDA	Tourism Development Authority
URL	Uniform Resource Locator

Executive Summary

The Southern Red Sea Coast of Egypt is an environmental treasure of global importance. The coral reefs are among the most spectacular in the world. The beauty of the coastline and the natural treasures of the desert and sea have spurred a boom in tourism. Ironically, rapid development of tourist facilities now threatens the very splendors tourists come to see. In order to better plan and manage development of the area, to maintain biodiversity and economic growth, better information is needed.

This study looks at the demand and supply of information for the Southern Red Sea Coast. The focus in on ecological data and information, though physical and socio-economic data are also discussed. The study is based primarily on interviews with stakeholders (data providers and data users) with an interest in the Red Sea.

The stakeholders put forward that there is a need for better information. Better data are needed in nearly every category and specific data gaps are identified. Most notable of these gaps is the consistent demand for more precise ecological information, including data about the exact locations of species and natural communities. More information is also needed about physical properties of the Red Sea, including actions of currents and waves and the chemical and biochemical properties. Better information is needed on the impacts of tourists away from their hotels, where they travel in the desert and dive in the sea.

This better information would mean that, for example, developers would choose better, more appropriate sites to develop and would more appropriately tailor their plans to these realities. For the government it would mean that more sustainable protection and development would be provided, for example, from better quality reports such as EIAs leading to higher levels of compliance.

The limited use and utility of data and information could be attributed to a wide range of reasons. However, these reasons could be summarized as follows:

- Stakeholders do not know where the data are located.
- Data access policy or administrative hurdles block reasonable access.
- The data are too scattered to be reasonable accessed by individual projects. This is true of most existing biological data.
- The required data have not been collected. This is the case for most ecosystems data.
- Stakeholders lack the expertise to understand and apply the data.
- Stakeholders lack the technology to effectively interpret data and display the results.
- Stakeholders lack the resources to collect and use data or they do not consider the data a high enough priority.

Based on analysis of data demand, current status of data supply, and identification of gaps this report recommends that the Egyptian Environmental Affairs Agency Nature Protection Department take the leadership role to improve the status of ecological data management and use. This initiative is based on building a participatory program for a common information base to assist different stakeholders to collect, process, accumulate, exchange, and interpret the data in the context of development projects and conservation initiatives. Of participants, as an example, National Authority for Remote Sensing and Space Sciences or NARSS is identified as a leader in making better use of satellite imagery and GIS systems to interpret and represent the data on maps. Other agencies are cited as important collaborators to build and use ecological data, as well as physical and socio-economic data.

1. Introduction

1.1 Objectives

The overall objective of this study is to help better protect and develop the natural resources on the Southern Egyptian Red Sea Coast by improving the use of data and information for development planning and natural resources management. It is also to improve the monitoring and evaluation of progress toward policy reform objectives in the region. The specific objectives of the study include:

- Determine what types and characteristics of data and information are needed by the principal stakeholders in the region;
- Identify and describe what data exist, their availability, and how they are currently used;
- Produce a sample product that demonstrates how stakeholders can have better knowledge of and access to data; and
- Identify options for developing and maintaining a common information base that can be accessed and used by all stakeholders.

1.2 Study Area

The study focused on the southern marine and coastal zones from Safaga south to the border with Sudan, including the entire watersheds that drain into this part of the Red Sea. Extensive development for tourism over the past 20 years has substantially degraded nature resources along the Red Sea coast of Egypt. Although natural resources along the southern coast of the Red Sea remain largely intact, they are imminently threatened by development projects similar to those held responsible for many of the problems to the north. Nevertheless, while this was the intended area of focus, necessarily many of the sets of data and information described here cover a larger area of the Red Sea coast or even of Egypt.

1.3 Stakeholders

Stakeholders identified in this study range from individuals and organizations that generate original data, to those institutions that aggregate data and generate information products, to those who use data and information to plan development activities and conservation programs, and to those who monitor and report on the changing conditions in the region. Probably the most important stakeholders are the government agencies that control the land and promote development activities in the region, including the Tourism Development Authority (TDA), the Red Sea Governorate (RSG), and the Egyptian Environmental Affairs Agency (EEAA), which is responsible for monitoring compliance and enforcing environmental regulations, as well as establishment and management of protected areas. Investors in the tourist resorts and related business are also important stakeholders. Stakeholders also include other government agencies, universities and other research institutions, as well as local and international NGOs that gather baseline data, assist with monitoring environmental conditions, and contribute to nature conservation initiatives in the region.

1.4 Methodology

Information for this study was gathered through interviews with stakeholders and review of selected sources of data and information and other means. A list of the people interviewed is included in Annex 1.

This study focuses primarily on ecological and physical data and secondarily on socio-economic data. It is in the interest of developers and the government to protect and manage the environment, since the ecological and the physical environment are the very assets that draw many tourists to the area. Therefore, developers and government stakeholders, and those responsible for monitoring and protecting the environment, all need data and information on the status of physical and environmental resources.

Socio-economic data describe the human factors in the study area. An enormous influx of tourists and increases in the permanent local population, including in areas that are currently uninhabited, are the greatest threats to the environment. Hence the need for socio-economic data that can be used to monitor human impacts.

Information for the report was gathered through the following methods:

- **Interviews with Stakeholders**
  Interviews were carried out with officials in stakeholding institutions to identify their data needs, learn what data exist, and about their policies regarding data release, and experiences with attempting to access and use existing data. The stakeholders also provided insight to any policy-related issues that may influence availability, accessibility, and usability of data and information.

- **Data and Capability Review**
  Institutions were visited to view firsthand their databases and to identify institutional capacity to provide data products and information services.

- **WWW and Literature Review**
  The World Wide Web and printed literature were searched to identify and review the data sets relevant to the study area. There are thousands of small data sets, theses, and articles in scholarly journals and proceedings from conferences. Only a small fraction of these relevant sources were selected for inclusion in the study. The major purpose of the intentionally selected sample is not to be exhaustive but to be illustrative as a demonstration of the multiplicity of data types and sources. The sample selected shows the diversity of institutions that collect and provide data, the different sorts of data (e.g., physical data includes information about geology, soils, weather, water chemistry, etc.), and the different formats and sources, such as libraries for printed books, institutions with databases, and the Internet.

Selected data sets and reports were reviewed to determine spatial and temporal boundaries, methodology, content, accessibility, etc. These findings are reported in the data catalog.

The Catalog of Data Sources (a separate volume appended to this report) is a demonstrative document of metadata compilation and organization for better accessibility. It includes descriptions of nearly 50 selected sources of data reviewed in the course of the study. The information in the catalog is divided into the following sectors:

- Ecological data (ecology, biodiversity, coastal, marine and terrestrial ecosystems, etc.);
- Physical data (topography, geology, geomorphology, climate, oceanography, etc.);
- Socio-economic data (demography, infrastructure, economy, etc.)

Many data sources combine ecological, physical, and socio-economic data in databases (including GIS data sets) and information products. In the printed catalog these aggregate data sets were assigned to a single category based on what data the team considered dominant in the data set.

The study team was headed by Dr. Ali Nasser Hassan, the local consultant, and included Richard Warner, the expatriate consultant, and Heba Gaber as the team coordinator. Dr. Tarek Wafik of MVE provided overall management of the work. Interviews with stakeholders and review of data sets were primarily conducted in February and March 2001.

1.5 Outputs

There are two outputs from this study. The first is this report, which describes the problem, methodology, and findings, and proposes options for development of a common information base contributed to and accessible by all stakeholders in the study area. The second output is a metadata catalog classifying and describing the selected data and information reviewed in the course of the study. The produced catalog – as mentioned before - was not intended to cover all existing data and information sources but only to serve as a demonstration and preliminary base for an eventual further expanded and regularly updated product.

2. Data Demand

The demand for data was primarily determined by asking the stakeholders what data they need and investigating these potential needs. Additionally, based on their experience, the study team forecast additional demand for data and information, particularly for larger, synthesized databases and information services that are scarce in Egypt.

The spatial scale of required data is often a function of the scale of decision-making. For example, regional planning and zoning for land use can be adequately addressed using small-scale (low resolution) data and information. On the other hand, large-scale (high resolution) data and information are needed for site-specific planning as well as monitoring impacts. Interviewees made this distinction of scale in the context of needing more detailed data. Several interviewees cited the reports and database produced by the Red Sea Coastal and Marine Resources Project, funded by the Global Environment Facility (GEF), as examples of low-resolution information products useful at the regional level. Stakeholders went on to identify the need to acquire more

site-specific data, including but not limited to precise location of sensitive species and habitats, archaeological and other cultural features, and information about the cultural and social profiles of the local inhabitants. Different interests of stakeholders are reflected in the type and scale of data and information needed. TDA for example expressed a desire for high-resolution site specific data used to delimit "setback lines" for tourism development projects along the coastline.

2.1 Demand for Ecological Data

Many stakeholders identify maintaining biodiversity, of the coral reefs in particular, as essential to sustainable growth of the tourism industry in the study area. In order to maintain and manage the rich biological diversity that is an integral and indispensable part of the study area, adequate data and information about biological resources and their ecological context are needed. Data are needed about species and ecosystems, their distribution, condition, and management requirements. Most ecological data are needed at a large scale or high resolution, providing details needed to manage and monitor habitats and individual populations of species at specific sites.

The most pressing demands for ecological data and information relate to planning and monitoring of development projects, including hotels, marinas, the support infrastructure such as housing for employees, and the remote impacts of tourists visiting attractions distant from their hotels. EIAs for these activities require biological data, much of which must be collected specifically for each development project. For example, to consider the expected impact of construction work, inventory data must be collected about the locations and conditions of species and ecosystems in the areas that will be impacted by a project.

Tourism development projects need data to address impacts that increased tourism will have on biological diversity not only at construction sites of hotels and marinas, which are currently the focus of EIAs, but also at the surrounding areas. For example, the EIA and subsequent monitoring of a hotel project require data about the biota that live in the reefs, wadis, and mountains that the tourists will visit.

The data from these inventories of species and ecosystems must be combined with information about the biology and ecological requirements of the biota present that might be impacted by project activities. Very specific data are needed about endangered species and sensitive ecosystems. To protect and manage these sensitive biological resources, a wide range of stakeholders needs to know their geographic range, habitats, threats and species biology (e.g., reproductive habits, food requirements, etc.).

In order to monitor impacts, periodic inventories are needed and comparable pre-project inventory data must be available for comparison with post-project conditions. For monitoring of project impacts it is essential that the data collected during the project planning process, specifically within the EIA preparation, and data collected periodically thereafter, be archived in a way accessible by all stakeholders. This mandates using uniform standard procedures for data collection and processing along the many steps of the EIA and subsequent inventories. There is a need for a high-quality and cost-effective regulatory program to secure such uniformity. A common information base - as proposed in this study - addresses this issue.

The type of demand for the following sorts of ecological data and information could be summarized as follows:

- **General descriptions of biodiversity** for species found in the area. This includes descriptions of the species appearance, distribution, habitat requirements, reproductive biology, etc. For ecosystems this includes their distribution and characterization, for example, what species dominate the ecosystem and what soil substrate or water conditions are required.
- **Inventories** of ecosystems and species. This includes data collected at a **high resolution**, for example, indicating exact locations of individuals of a rare plant (e.g., within a meter) or precise composition of coral reef at a specific site. It also includes data collected at a small scale or low resolution that might be represented as range maps indicating where ecosystems and species occur in the study area.
- Monitoring programs require **data series** that result from inventories collected over time following prescribed methods.

In addition to the demand for data, the complexity of biological systems and their interconnectivity add substantially to the need for expertise to interpret the information in the context of specific projects. For example, information on species biology is essential for understanding how commercial deep-sea fisheries can be impacted by coast or terrestrial activities, which may impact reproduction of the commercial species or of their food.

2.2 Demand for Physical Data

Physical data describes landscape topography (e.g., location of mountains, wadis, shoreline, reefs, etc.), geology and soils; ocean tides, currents, waves and water chemistry; temperature, wind and rainfall; and many other features of the physical surroundings. Low-resolution physical data are useful for regional planning and monitoring long-term trends. However, it is nearly always the case that site development, resource management, environmental monitoring, and many other activities require detailed (i.e., high resolution) physical data.

The demands for physical data are diverse. Stakeholders frequently require detailed physical data for specific projects, including, for example, data on topography and water depth of the immediate site for construction of a building or marina. TDA needs detailed topographic and other data to establish setback lines for construction along the coast. Off-site data about topography and climate are needed to predict the potential magnitude of periodic flooding events in wadis. Boat captains need to know tides and locations of reefs in order to safely navigate. Sea depth, locations of reefs, water temperature, currents, and weather data can all be useful for locating fish for commercial and sport fisheries. Environmental monitoring of the Red Sea requires data on water chemistry and along-shore currents, among other data.

Natural resource managers need data on topography, geology, soils, water chemistry, and climate in order to classify ecosystems and to monitor the health of sensitive habitats and species, for example, mangroves that grow on alluvium deposited in the deltas of wadis. Therefore, the physical condition of the wadi, mountain rainfall and

sediment loads can be used to predict the future health of mangroves, or changes in these parameters might explain the decline of mangroves at selected locations.

As with ecological data, there is a need for data series that permit comparison over time. Using uniform prescribed methods for data collection and processing is necessary to fulfill the function.

The diverse types of physical data are difficult to characterize and summarize. Therefore, the following list is a sample of the types of physical data frequently mentioned by stakeholders.

- **Topography**, including terrestrial and marine. There are specific needs for information on drainage patterns, shoreline contours and the locations of coral reefs.
- **Geology and soils**, including the seafloor.
- **Oceanography**, including water temperature, chemical characteristics, currents, and wave actions.

In the following sections this sample of data types will be used to illustrate general trends in the status of physical data.

2.3 Demand for Socio-Economic Data

The tourism industry is responsible for most of the changes in the status of socio-economic parameters. Hence, there is a distinct need for data about tourism, including the data used to project tourism growth over the next 10 - 20 years. This includes How many nights is the average tourist expected to stay? What is the expectation for number of divers and boats per day? How many off-road vehicles are anticipated and where will they go?

To monitor and forecast tourism development there is a need to collect data on the actual results of the parameters previously mentioned. Hotels and other tourist business need to collect data on the number of nights a tourist stays and how they spend their time. The tourist industry and many other stakeholders need these data, including government agencies responsible for infrastructure (e.g., roads, power, water, etc.), and natural resource managers responsible for maintaining ecological conditions important to tourism and for protecting endangered species. Some of the socio-economic data about tourism are specifically needed by commercially-oriented stakeholders to improve tourism services and economic development. For example, boat and diver center operators want data about the number of boats and divers other tourists will tolerate on a reef at one time, because too many divers at one time detracts from the experience. On the other hand, natural resource managers want data about the number of boats and divers in order to monitor the impacts on marine ecosystems.

Demographic data are needed to monitor and forecast changes in the local population and labor force. For example, where do the new employees come from? Are they permanent residents or seasonal? Do they live in towns or near the remote hotels? Do they make new settlements? Similarly, data are needed on local economic parameters, such as government spending, personal income, and cost of living. Outside the cities and off the coast, data are also needed to determine the influence that tourism, mining, and other activities are having on local populations.

Data are needed for infrastructure planning, particularly in response to rapid population growth. Data and information about roads, water and sewer facilities, power production and distribution, disposal sites, and more are needed to plan urban development.

There are many more types of socio-economic data. For each of these data types there is a need for current data, and data series. The general types of socio-economic data identified above can be summarized as follows:

- **Tourism data**, such as the statistics of tourism inflows, their seasonal variations and destinations, duration of stay, accommodation level distribution, activities, etc.
- **Demographic data** describing population, growth rates, migration, etc.
- **Economic data** describing financial and economic aspects of tourism, government and local population. It also includes tourists expenditure, tourism revenues for the different sectors…etc.
- **Infrastructure data** that describe the, roads, water and waste water facilities, electric power-grid, etc
- **Urban development data** that describes the existing type and spatial and density patterns of physical development.

3. Overview of Data and Information

Table 3.1 below summarizes the analysis of ecological, physical, and socio-economic data and information reviewed in this study

3.1 Ecological Data

3.1.1 Status and accessibility

There are hundreds, perhaps thousands of sources of data and information about ecological resources in the study area. They range from site-specific reports, such as EIAs, to global resources, such as World Wide Web sites that, for example, provide information about fish worldwide. More than 100 years of scientific research has resulted in thousands of published articles and millions of museum specimens relevant to biota and ecological processes in the study area. However, to many stakeholders, the data and information contained in these sources are so dispersed that they cannot be reasonably accessed and applied to a project. As an extreme example, consider the level of effort that would be required for consultants conducting an EIA to review millions of museum specimens (most of which are in Europe and are not computerized) to determine if any were collected from their project area. These dispersed sources of data are extremely useful for many applications, but are problematic to use within the time and budget constraints of most projects. In summary, there is an abundance of ecological data, but very little of it is used effectively by most of the stakeholders identified in this study.

Generalized information about species is moderately well organized and accessible, at least for better-known groups such as higher plants, vertebrates, and a few groups of invertebrates. The NBU and the floral databases at Ain Shams University both have some general descriptive information about species of Egypt. Unfortunately, it seems that few stakeholders are using the information from these sources. The species in many of the better-known groups (e.g., birds, mammals, vascular plants, etc.) are described in books and on the Internet. In fact, information about most species, even many obscure species, can be found on the Internet.

Generalized information about ecosystems, habitats, or natural communities is scarce and what does exist is poorly organized. Lack of standard classification systems is a major hurdle to organizing ecological information. While scientists largely use a standard system for classifying and naming plants and animals, there is little agreement about how to classify ecosystems. Without a classification system, general descriptive information is difficult to compile. There are exceptions among easily circumscribed natural communities, such as mangroves, for which there is descriptive information.

Maps showing the range of species or ecosystems often best represent low-resolution inventory data, but more often are given as written descriptions. Range descriptions or maps are readily accessible for many of the better-known species, a surprising number of lesser-known species, and a few well-defined ecosystems. This information is available in books and with increasing frequency on the Internet. Satellite imagery can provide low-resolution data about the distribution of ecosystems, and has been used with some success to describe the distribution and status of mangroves in the

region. The GEF project was the largest effort to organize biodiversity information at a high resolution for the study area. The GEF project report provides reasonable low-resolution descriptions of biodiversity for the coast region. The GEF database is not easily accessed, apparently because no policy exists for its accessibility.

A useful immediate action would be to make the GEF project GIS database available to EEAA and the Red Sea Governorate together with original data files. It follows that training of staff members in these entities on using the database is essential. The only copy of these data is present at TDA, however, not all modules are functioning. Therefore, coordination between the end users and the GEF project team is mandatory to organize, distribute, and operate this information product.

There is a great deal of site-specific biological data to be found in museum archives and scientific literature, but they are not often organized in ways useful for the most pressing demands in the region today. These data are generally accessible but to extract the useful information requires special skills, experience and more time than is generally afforded by independent projects. Some site-specific data are collected through the EIA process, but these data are difficult to aggregate and preserve so that they might be applied toward the accumulated knowledge of biodiversity. Organizing EIA data is problematic, in part, for the lack of standard methodologies for data collection. In some cases - not just for EIA - the site-specific data cannot be found and may be entirely lost. For example, the study team was unable to locate the field observation records that are the basis for the GEF project databases and reports; only a portion of the field observations were recorded in the database and even less in the printed reports.

Except for a few research projects, there are currently no ongoing inventories of biodiversity expected to result in data series for the study area. The GEF and the USAID funded project of Environmental Sustainable Tourism laid groundwork for ongoing inventories. Satellite imagery captures periodic data sets about biodiversity in the region, but without ground surveys to verify and characterize the satellite images, they are of limited use.

3.1.2 Gaps in Ecological Data

General descriptive information about biodiversity is fairly well organized and there are programs in place to continue and expand this work. Considerable data are available in scientific papers published in local and international journals, and in the major museums and herbaria of the world. However, a major effort is needed to market these information resources to important stakeholders. Urgently needed site-specific biological data are scarce for the study area and what specific data do exist are seldom accessed for small, independent projects.

The sheer number of species in Egypt or even just in the Red Sea region, rules out a timely program to organize useful information about them all with sufficient detail to meet immediate demand. An ecosystem or natural community approach can be usefully applied as a coarse filter that will capture perhaps 80% of the species and ecological processes that need to be maintained for a healthy ecosystem. Shaker (2000) used this approach on a very coarse scale in his evaluation of protected areas.

The "natural community approach" to inventory and management of biological resources will not be successful for species that are rare, in decline, or threatened. These species must be the target of data programs that specifically address their needs. Thus, a two-tiered approach can be employed where natural communities serve as a coarse filter for inventory and management of most species, while a fine filter captures those species that are too rare or threatened to be effectively addressed by the coarse filter.

For species and ecosystems or natural communities, information is needed on conservation status, threats, and management options. For example, more data are needed about the types of marine ecosystems, their distribution, and the conditions required to maintain healthy examples of each type. More information is also needed about the rare species, such as marine turtles. In addition to better biological data, better data are likely also needed about coastline dynamics, where physical parameters such as periodic floods may be essential to the survival of near shore natural communities and their associated rare species.

3.1.3 Institutional Options for Improving Ecological Data and Its Use

This study looks specifically at how data and information are applied to development and to protection of the environment and natural resources. Experience in many countries has shown that a close fit to institutional mission is essential for sustaining a biodiversity inventory program. The EEAA Nature Protection Department (EEAA/NPD) appears to be the best candidate to take a leading role in developing a biodiversity database and program to help stakeholders to apply biodiversity data in meeting their needs.

For general descriptive information, the EEAA/NPD, the National Center for Documentation of Cultural and Natural Heritage (NCDCNH), and Ain Shams University (Flora project) should collaborate and coordinate to avoid duplication of effort, while expanding their overall programs to produce general descriptive information for the biodiversity of Egypt. The stakeholders of biodiversity information should collaborate also with other national institutions and with international programs doing similar work, particularly those distributing data on the Internet (see www.fishbase.org as an example). Launching a new effort to describe and inventory ecosystems and natural communities seems an urgent mission for EEAA/NPD to undertake.

The generalized biological data currently available through the GEF project, the NBU, museums, and from many publications and Internet sites could be used to build a foundation for an effective databank on the biodiversity of the study area. An inventory of biological resources should be established limited to the study area (or extended to the entire Red Sea region of Egypt). The initial focus of the inventory effort should be on ecosystems, natural communities, and threatened and endangered species. Any effort to inventory all species equally may require decades before it can provide products useful to many of the stakeholders identified in this study.

To develop the inventory data, the NPD might develop relationships with stakeholders that both use their information and contribute to growth of the databank. For example, they could improve information services to the EIA program, including consultants

working on EIAs. In turn, for services provided, EEAA should require that data collected during EIAs be shared with the EEAA/NPD where they can be aggregated into a continuously growing knowledge base. Collaboration in building an effective biodiversity database will require setting standards for the collection and presentation of ecological data.

3.2 Physical Data

3.2.1 Status and accessibility

Data and information about many aspects of the physical environment are in better condition and are mostly accessible. The data exist in many formats, including text descriptions, printed maps, and digital formats, including satellite imagery. In fact, many stakeholders have identified satellite imagery as an important source for physical data today. Information provided by new, very high-resolution and hyper-spectral satellite platforms can even help to meet the demand for site-specific information. Satellites collect data on a periodic basis and the results are archived where they can be accessed by virtually anyone, though sometimes at considerable cost. Thus, data series are being developed all the time. Use of satellite data requires special software, hardware, and training, all of which stakeholders can obtain from providers such as NARSS.

Satellite imagery can provide high quality, cost-effective data. However, for many applications the satellite data must be augmented with measurements taken from the ground, sea, or air. Many of the better-known physical features were surveyed in the field years ago and the data are still useful. For example, data on geology and soils have been available for many years, including general descriptions, maps, and more recently, digital products. The soils and geologic data are based on years of on-the-ground research.

High quality topographic information has been available for decades as printed maps and digital topographic data are increasingly available. Satellite imagery, including new laser scanner technology, is now being used to refine the precision of topographic data and the mapping of soils and geologic features on the mainland and shoreline.

Topographic and substrate features of the Red Sea were never described as thoroughly as their terrestrial counterparts. Furthermore, satellite imagery has not improved data about the sea floor as effectively as it did for the mainland. Most of the data on physical oceanography (tides, waves, currents, etc.) are also old but still valid for some uses. However, they are not as complete or reliable as data about the more stable terrestrial features. Some water quality data (physical, chemical and biological) for the study area has been collected on a systematic basis since 1998, but are not freely accessible.

As described in section 2.2 there are many other physical aspects of the environment for which the stakeholders require data. An exhaustive and detailed review of the data needed is beyond the scope of this study.

3.2.2 Gaps in Physical Data

For the data reviewed in this study, the most pronounced gaps are related to the marine environment. Stakeholders from tourist operations to environmental managers need better information about the physical properties of the Red Sea. There is also a technological gap that prevents many stakeholders from taking advantage of the data represented by satellite imagery and aerial photography.

3.2.3 Institutional Options for Improving Physical Data

Satellite data and related value-added products

The National Authority for Remote Sensing and Space Sciences (NARSS) already possesses a good archive of remote imagery on the Red Sea. They have produced an Atlas for Egypt that serves as a good baseline on the natural and urban environment against which impacts of developmental activities can be evaluated and assessed. They are currently in the process of publishing a complete atlas on the Halayeb/ Shalateen area as well that would serve environmental planning for this part of the coast.

In the near future NARSS will be able to receive real-time data from several earth observation satellites through a huge ground receiving station. Such data can be used for many applications related to the development planning and protection of the Red Sea region through the use of different space platforms and different spatial resolution images.

Data provided from new satellite sensors specialized for marine and climatological applications can be used to generate up-to-date information on the main characteristics of the coastal and marine environment, both ecological and physical. This is in addition to the availability of historic information, which would allow the assessment of environmental performance and impacts under current management practices, plus their uses in law enforcement.

NARSS has sophisticated software and hardware that can deal with remote sensing data and integrate it with any other data sets in a GIS environment to support development planning, monitoring, and enforcement. They also can support capacity building through training in information systems, GIS and image processing technologies, and decision-support systems. NARSS is currently cooperating with various ministries providing them with the required images and analysis. However, as there is no significant cooperation between NARSS and the EEAA or TDA they might not be fully cognizant of the current NARSS capabilities.

Oceanography and coastal dynamics

The Coastal Research Institute (CRI) has the facilities and expertise to carry out complete hydrographic surveys and other coastal studies (sediment transport, erosion, protection, etc.). Most of its activities are currently directed towards the Mediterranean Sea. Based on available expertise, CRI can help to bridge the data gaps in this field putting into consideration the needed programmatic arrangements and cost implications.

Marine water quality and resource assessment
The National Institute for Oceanography and Fisheries (NIOF) has up-to-date equipment and facilities, including boats, to carry out detailed monitoring and inventory of marine water quality and fish catch assessments. NIOF is currently supporting the EIMP project by collecting water quality data along the Red Sea coast. Dive centers and dive boat operators could contribute – through voluntary arrangements - to data collection.

3.3 Socio-Economic Data

3.3.1 Status and accessibility

As the priority focus of this study is the ecological data a thorough review of socio-economic data was beyond the scope of this study. The analysis here focuses mainly on a selective sample of the study. However, the fact that particular data are not mentioned in the study does not necessarily indicate an absence of such data. More research is needed to clarify the status of socio-economic data.

The Ministry of Tourism manages most of the national data on tourism and the TDA holds additional data for the study area. However, such availability pertains only to specific aspects. For example, data on tourism earnings can be regularly obtained from both Ministries of Tourism and Economy, while at the same time information about the activities of tourists is not routinely collected, so there is little information with which to assess their impacts on the environment.

Demographic and economic data are mostly managed and distributed by CAPMAS. These records are updated every ten years; the latest was published in 1996. The data in these records is quite accurate and suitable to support various environmental indicators. Other data are being collected and made available continuously.

The General Organization for Physical Planning (GOPP), the Red Sea Governorate, and TDA collect and manage substantial data on infrastructure in the study area. The data focus on cities and tourism development sites, and are largely prepared for planning and managing urban tourist infrastructure. The infrastructure data are regularly updated with the aid of satellite images and are excellent and detailed. The infrastructure data are generally accessible.

3.3.2 Gaps in Socio-Economic Data

More information is needed about how tourists impact the environment. There is an urgent need for data that address the cumulative impacts of the built environment and tourism on ecosystem. Studies or reports were found that address the carrying capacity of ecosystems to accommodate current and future development plans. The information on culture and traditions of the local and native people of the study area is available at many institutes yet scattered and unknown.

3.3.3 Institutional Options for Improving Socio-Economic Data

The responsibility for urban planning and tourism development lies with the GOPP, TDA, and the Red Sea Governorate. These organizations, with technical assistance from NARSS, could collaborate in preparing a comprehensive database and maps describing all development impacts anticipated over the next twenty years. In collaboration with the Ministry of Tourism they could estimate the number of tourists expected to impact natural resources (e.g., divers, fisherman, back country hikers, and off-road drivers). The Ministry of Tourism – through contribution from tourism business operators - could collect data on the destinations of tourists.

CAPMAS or other relevant institutions – such as regional universities and research centers - could intensify collection of demographic and economic data to provide more detailed data of a socio-economic profile for areas of intensive growth. Information and data on the impact of development on local and native peoples could be collected in cooperation with the different institutions concerned with cultural heritage.

Table (3.1) Summary of Data Demand and Status

Data Needed	*Status*
Ecological Data	
- General Descriptions of Biodiversity	Moderately good with much room for improvement. For species the data mostly exist, but are not effectively organized. Good progress being made to organize data about higher plants and vertebrates; little progress with lower plants and invertebrates. Ecological classification is unstable and descriptive materials are scant.
- Low resolution Inventories (for regional assessments and planning)	Moderately good, but with much room for improvement. The GEF project provided substantial information at this scale.
- High resolution Inventories (for site-specific)	The greatest demand for inventory data is for location-specific high-resolution data. Substantial data are collected (e.g., EIAs), but not effectively compiled and archived for future uses. In some cases the data are completely lost. There are a few ongoing inventories of biodiversity, but what data are collected is often difficult to access and use.
- Data Series	Few sustained efforts to collect low-resolution data series for monitoring biodiversity, determining the results of management interventions, or measuring impacts of development projects. High-resolution data collected by satellites, but seldom complemented with timely ground surveys. Few established protocols and procedures for collecting data series.
Physical Data	
- Topography	For terrestrial topography there are excellent data available from printed maps and increasingly in digital formats. Topography of ocean bottom is not well known, but is still adequate for most low-resolution applications and some high-resolution applications.
- Geology and Soils	Good data and information are available at scales that meet most immediate needs. Note that standard international classification systems have greatly facilitated data gathering and organization, and the ability of users to interpret the data to their application.
- Oceanography	Data are inadequate to meet most needs. Little historic data exist and the few data currently being collected are not systematically aggregated and archived.
Socio-Economic Data	
- Tourism	Study did not fully investigate this type of data. Businesses and government routinely gather data, but these data are not effectively aggregated, archived, and made available.

Data Needed	*Status*
	Additional data are needed about tourist activities outside the resorts, including volume of off-road traffic at specific destinations, and number of boats and divers at islands and reefs.
- Demographic	Study did not fully investigate this type of data. Census data available every ten years, but more timely information is needed during the current period of rapid growth. Data needed relates to the demographic and socio-economic characteristics of affected local population, fast-growing urban centers, and projections of future growth..
- Economic	Study did not fully investigate this type of data. Data are needed to appraise the economics of tourism development such as investment rate, projected future growth, tourist expenditure, returns distribution, and resources allocation. Data inputs for studies of environmental economics – for example - could eventually contribute to adequately financed and sustainable environmental management of the region.

- Infrastructure	Good data are available for some cities. Study did not fully investigate this type of data, but there is likely a need for more timely, specific data about new coastal developments, including projections for expected construction; this should include piers, marine fuel storage, mooring buoys, wastewater treatment plants, solid waste disposal facilities, etc.

4. Institutional and Legal Framework

Three institutions are responsible for management of the environment in the study area: Egyptian Environmental Affairs Agency (EEAA), Tourism Development Authority (TDA), and the Red Sea Governorate (RSG).

- EEAA's main functions are the implementation of law No. 4/94 and the promotion of environmental information and awareness, environmental monitoring, environmental management, and natural protectorate management (principally through Law No. 102/1983).
- The RSG is responsible for the Red Sea cities and their buffer zones and the coordination of various ministerial activities.
- Development of the coastal strip (beyond administrative boundaries of cities) lies under the authority of the TDA, whose responsibilities include environmentally sound regional planning and promotion for tourism development.

These three entities are the most important stakeholders in terms of data generation and use, and EEAA has major responsibilities to collect, manage and distribute data and information products.

Egyptian Environmental Affairs Agency (EEAA)

EEAA is the central institution responsible for environmental protection in Egypt. Operating under the Ministry of State for the Environment, EEAA has a wide range of functions, which include administering the comprehensive requirements and regulations encompassed under laws No. 4/94 and No. 102/1983. The functions relevant to the Egyptian Red Sea Coast include:

- Revision and approval of the Environmental Impact Assessment studies of development projects, including tourism development on the Red Sea coast
- Management of the Red Sea protectorates.
- Co-ordination management of the National Committee for Integrated Coastal Zones Management (NCICZM).
- The establishment and operation of a Red Sea Coastal Zone Management Unit
- Design and management of a National Oil Spill Contingency Plan.
- Environmental Information and Public Awareness.

The EEAA / Information Systems Department is responsible for integration of data and development of information systems within EEAA. The Environmental Information and Monitoring Program (EIMP) and the Egyptian Environmental Information System (EEIS) are units of this department. These units document and support metadata standards, collect and manage monitoring data, and develop and support information management systems.

The EEAA / Nature Protection Department (NPD) has the direct responsibility for managing the Egyptian protectorates. Department staff undertake this responsibility in the capital and in the field. It is also responsible for organizing and maintaining ecological and biological data and information. It supports ecological classification and inventory, rare species inventory, biodiversity monitoring programs, and inventories of biodiversity in protected areas. The National Biodiversity Unit (NBU) in this department provides biodiversity data and information service and products.

Other departments and programs in EEAA are important stakeholders. Regulatory programs, such as EIA, are also a user of information and have the potential to generate other new biodiversity information from field surveys conducted during preparation of EIA studies.

The responsibility for coastal zone management is assigned to the "Coastal and Marine Zone Management Unit" of the Environmental Management Department, which also acts as the National Committee for Integrated Coastal Zones Management Committee (NCICZM) Secretariat. This includes a Red Sea Coast sub-unit responsible for both Suez and the Egyptian Red Sea.

Red Sea Governorate (RSG)
Though the Governorate has the full administrative authority over the whole study area, with the exception of those lands currently managed by TDA and offshore marine resources on which it has partial control, it is largely focused on municipal areas and tourism along the coast within municipalities. Governorate responsibilities are expected to expand as lands developed under TDA revert to Governorate domain. The Governorate co-ordinates the interests of various ministries and the private sector in the study area, including such items as building permits (beyond TDA domain) and environmental monitoring of development projects. Its local presence and long-term responsibilities for the well-being of the local people make the Governorate an essential partner in coastal resource management and long-term monitoring.

Tourism Development Authority (TDA)
TDA is a Ministry of Tourism agency with authority over tourism development of undeveloped areas of Red Sea Coast. Once developed, the lands revert to the control of the RSG. TDA's primary responsibility is to promote and support private sector tourism development. TDA is a key stakeholder, interested in maintaining environmental conditions needed to sustain economic development in the region and it contributes substantially to environmental planning and management in the study area.

Other Important Stakeholders
The **National Authority for Remote Sensing and Space Sciences** (NARSS) is the lead entity for collecting, organizing and archiving satellite imagery and aerial photography. NARSS has a substantial GIS and remote sensing lab providing value-added information products and services to many stakeholders**.**

The **Ministry of Tourism** is responsible for collecting and maintaining information about tourists. They generate information products for different stakeholders.

The **Ministry of Agriculture** has responsibility for inventory of fisheries, as well as agriculture including livestock resources (grazing animals) in the region. The **Egyptian Meteorological Authority** collects and disseminates data on climate.

The **National Institute for Oceanography and Fisheries** is currently collecting data on water chemistry under contract from the EEAA / EIMP. The **Coastal Research Institute** (the National Water Research Center) collects data on physical properties (tides, currents, wave properties, etc.) of the Mediterranean Red Sea, an experience they could quickly apply to data needs in the Red Sea. The **General Authority for**

the Protection of Shores (GAPS) contributes in defining standard survey methodologies for EIAs of coastal projects and assists in their review.

Universities are important generators of primary data sets, including museum archives and field research data. They provide training of all kinds and contribute to innovations in design of information systems.

Other government stakeholders include the **General Organization for Physical Planning** (GOPP), the **Ministry of Petroleum** (MOP), the **General Authority for Fish Resources Development**, the **Ports and Lighthouse Authority**, and the **military**.

The **private sector** stakeholders (developers, hotel and tour operators) are primarily data users, but can also contribute to collection of new data about tourist activities, including information on tourists (e.g., length of stay, number of dives and safaris, etc.) The private sector, investors, developers, and industry, as well as NGOs, all need to be included in the consultative process and partnership for better generation and use of information.

National Legislative Framework

There are approximately 200 national laws and decrees in Egypt that both directly and indirectly regulate coastal development, and aim at the protection of the marine and coastal environment. The following are of particular significance: Law No. 4 (1994) for the Environment, which resulted in the foundation of the EEAA; and Law No. 102 (1983) regulating Protected Areas.

The main provisions of Law No. 4/1994 address the operational role of the EEAA by:

- Providing EEAA with enforcement powers to co-ordinate environmental management and pollution control.
- Ensuring that all development is subject to an appropriate level of EIA supervision and guidance.
- Setting up an Environmental Protection Fund with sufficient resources
- Establishing an Environmental Management Unit (EMU) in each Governorate to help co-ordinate and implement EEAA's mandate on the local level.
- Establishing and co-ordinating environmental information and monitoring networks to guarantee an effective implementation of the Agency's mandate.

Articles 59 and 60 of Law 4/94 have far-reaching implications for the design of new coastal resorts. Article 59 prohibits the construction of any establishment within 200 meters of the shoreline, except with the approval of the Egyptian General Authority for the Protection of Shores (GAPS), in co-ordination with EEAA, and after the approval of a satisfactory Environmental Impact Assessment (EIA). Furthermore, Article 60 prohibits all activities that cause any alteration or modification to the natural shoreline.

The Egyptian Conservation Law no. 102 (1983) established the framework for the creation of protected areas. The Nature Protection Department (NPD) of EEAA administers its enacting. The Law provides an extra level of protection by prohibiting exploitation and disturbance of both living and non-living resources and restricting both the level and scale of activities that take place within protected areas.

Programs Addressing the Environment in the Red Sea

The scope of relevance to the issue of the needed common information base extends to include other ongoing initiatives that are concerned with protection of resources of the study area. Institutions involved in these initiatives would benefit – and subsequently would be more effective - from improved conditions of data and information collection, processing, dissemination, exchange, archiving, etc, as would be developed in a programmatic effort addressing the proposed common information base. A sample of these initiatives includes:

- *National Integrated Coastal Zones Management Program.* This is a formal national process targeting Egypt's Mediterranean and Red Sea coasts. It is implemented through a National Committee (NCICZM) made up of key coastal-marine agencies, with EEAA as the principal actor.

- *National Environmental Action Plan (NEAP)*: This was initiated in 1991 as a comprehensive strategic framework for targeting and co-ordinating environmental activities for all of Egypt.

- *Egyptian National Strategy and Action Plan for Biodiversity Conservation:* the process is led by the EEAA in partnership with many associates. The primary targets include: an expanded national network of protected areas; an enhanced research and monitoring programme; and a national biodiversity data inventory network.

- *Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)* is a UNEP/GEF regional project for conservation of the Red Sea.

- *International Coral Reef Initiative (ICRI) and the Global Coral Reef monitoring Network (GCRMN)* are international networks that collaborate to monitor the status of coral reefs world-wide.

5. Recommended Strategies for Improving Use of Data and Information

5.1 Recommended Strategies for Immediate Action

Based on the previous analysis of data demand, the current status of data sets and information, and the data gaps, general strategies for improving use of data and information have been devised considering the current conditions of the study area and the institutional setup. The strategies can be summarized as follows:

- **Upgrade already existing data processing, organization, compilation, and archiving and facilitate accessibility**– If existing data (for biodiversity in particular) were organized and made easily accessible, and used by the stakeholders, it would meet much of the demand for data and information. EEAA/NPD should take a much more active role in organizing biodiversity data and assisting stakeholders to interpret the data in the context of particular applications. Other departments in EEAA and NARSS should be full partners from the outset.

- **Fill critical data gaps.** Most notable is the need for data on ecosystems/natural communities, threatened and endangered (T&E) species and species of economic importance (fisheries in particular). Oceanography and social and economic profiles of local communities and their projected development-induced transformations are also of importance. A top priority for EEAA / NPD should be development of an ecological classification system and inventory that can be widely used for development planning and long-range monitoring. Other institutions should be identified to collect data on physical properties of the sea, on tourism plans, and on tourism impacts on the environment and local communities.

- **Establish monitoring program.** Select parameters to be measured over the long term for monitoring the environment. Collect baseline data on these parameters and establish the appropriate institutional framework for periodic sampling and reporting.

- **Make better use of already available scientific expertise and technology.** Stakeholders need to make better use of scientific expertise and technology both in Egypt and at the international level. The not-fully tapped capacity and resources of NARSS is a prominent example.

- **Prepare multi-sector synthesis of impacts.** There is a need to integrate data and information on the impacts of multiple projects over time and to evaluate the cumulative impacts on the environment and people.

- **Document policy and standard procedures**. Identify international standards for data collection, metadata, etc. that should be used by all stakeholders. Promote these through policy and programmatic requirements. For example, require that EIA biological surveys use specific methods and provide their field notes to EEAA.

5.2 Recommended Strategies for Specific Areas of Information

Table 5.1 summarizes and prioritizes the recommended strategies and options for improving the use of data and information for development planning, and environmental and natural resources protection. Operational/institutional recommendations articulating the identified strategies are as follows:

Ecological Data. EEAA Nature Protection Department should lead an effort to organize ecological data and facilitate access by stakeholders. Collaborators should include NCDCNH and the Ain Shams University Flora Project. The EEAA / NPD should focus on the following components:

- Update and maintain the ecological section of the proposed catalog.
- Develop a natural community classification systems and initiate inventory of the communities, beginning with rare communities and areas under intensive development pressure.
- Expand inventories of threatened and endangered species.
- Expand comprehensive inventories of protected areas.
- Create an outreach program and capacity to assist stakeholders to apply ecological data in the context of specific applications. Open an information office on the Red Sea Coast.

Physical Data. NARSS is best positioned to lead a consortium of players to organize and deliver physical data. Cooperators should include primary providers of data on geology and soils, CRI and NIOF for oceanographic data, and others. NARSS can also help to integrate ecological and socio-economic data into useful products.

Socio-Economic Data. The primary players should include the Red Sea Governorate, TDA, Ministry of Tourism, CAPMAS, and others.

The National Committee for Integrated Coastal Zones Management (NCICZM) is well positioned to lead in the integration of the primary data providers from the three sectors (ecological, physical and socio-economic). Another agency with responsibilities nationwide should describe metadata standards (adapted from international standards, see Annex 3) that can be adopted by the data providers identified for the Red Sea Coast.

Integration of efforts among so many institutions and with such complex data sets will take many years. Therefore, it is recommended that initial efforts focus on the sectoral level. For example, the EEAA should move forward aggressively to organize ecological data, not waiting for establishment of a higher-level framework by NCICZM or for national metadata standards.

Table 5.1 Recommended Strategies and Actions to Improve Use of Data and Information.

Relative priorities: HP = high priority, MP = medium priority, NU = not urgent (but still important).

Data Needs, Gaps & Issues	*Recommended Solution/Actions*	*Institutions*
Ecological Data		
Institutional framework for organizing and sharing biodiversity data	a. Substantially strengthen the EEAA / NPD. (HP) b. Upgrade computer and database system of the EEAA / NPD, including GIS and Internet access to data. (HP) c. Establish data sharing agreements among key institutions collecting and managing biodiversity information (MP) d. Establish a biodiversity information center on the Red Sea Coast. (NU)	EEAA/NPD, other EEAA departments, other Ministries, universities, and research institutes
General descriptions of biodiversity	a. Prioritize development of general descriptive data by taxonomic groups (e.g., birds, mammals, etc.) prepare thorough data on all species of selected groups. (MP)	EEAA/NPD, universities, global partners
Ecosystem/natural community classification and inventory	a. Design a classification system for ecosystems and natural communities of the study area. (HP) b. Classify terrestrial and marine communities at various scales. (HP) c. Prepare detailed inventories of the threatened natural communities. (MP)	EEAA/NPD, NARSS, universities and research institutions, global partners
Improve access to historical inventory data	a. Prioritize collection of historical data on species locations, perhaps starting with endangered species and species used to monitor environmental conditions (indicator species). (HP) b. Work backwards through the literature to glean information and incorporate it into the databank. (MP)	EEAA/NPD NARSS
New biodiversity data, including high-resolution inventory data and data series	a. Acquire data from current research and studies and organize the data for easy retrieval. (HP) b. Allocate specific resources annually for inventory of endangered species and sensitive natural communities. (MP) c. Require specific data be collected during EIAs and incorporate these data in the EEAA/NPD databases (MP)	EEAA/NPD EEAA/EIA Ministry of Tourism, private sector

Data Needs, Gaps & Issues	*Recommended Solution/Actions*	*Institutions*
	d. Expand biodiversity data collection through dive centers, tour boat operators, vehicle rental, and safari guides. (NU) e. Collect baseline data sets for monitoring specific parameters. (MP)	
Physical Data		
Topographic data	a. Acquire and archive historical remote imagery. (MP)	NARSS
Geological and soils data	a. Digitize existing geo-referenced data on soils and geology. (NU)	NARSS, other ministries
Oceanographic data, including physical and chemical	a. Establish data collection and monitoring program for core parameters, including shoreline dynamics, physical and chemical properties of marine water. (MP) b. Expand data collection through dive center and tour boat operators. (NU)	NIOF, CRI, private sector
Socio-Economic Data		
Tourism, including cumulative impacts	a. Collect data from tourism development plans and urban growth projections, archive in a common database, and make reports available to all stakeholders and the public. (HP) b. Request hotels, dive centers, tour boat operators, vehicle rental offices and safari guides to provide activities reports, including number of tourist and places visited. (HP)	Ministry of Tourism, TDA and RSG, private sector
Demographic and economic data	a. Monitor demographics closely during periods of rapid change and make the data available to all stakeholders earlier and more regularly (MP) b. Conduct overall assessment of how growth in tourism may impact local communities and cultures. (MP)	CAPMAS, Ministry of Tourism, TDA, RSG
Infrastructure	a. Expand production of digital, geo-referenced products describing the built infrastructure and urban development. (NU)	NARSS, RSG and TDA
Procedures, Technology		

Data Needs, Gaps & Issues	*Recommended Solution/Actions*	*Institutions*
& Expertise		
- Standard methods for data collection	a. Adopt international recognized methods for data collection whenever reasonable. For example, EEAA might require the use of rapid assessment methods (REA, RAP, or other methods) for inventories of coral reefs. (MP)	EEAA, CAPMAS, Other Ministries
- Metadata standards	a. Adopt international metadata standards. U.S. FGDC standards are a reasonable choice. (MP)	EEAA, NARSS, others
- Remote sensing and GIS technology	a. Improve access to technology and expertise for use of data from satellite images and for production of maps; provide training to organization building GIS operations and increased opportunities for contracting services. (MP)	NARSS overall lead, others

6. Options for Maintaining and Updating the Catalog of Data Sources

6.1 Operational Objectives

The Catalog of Data Sources (attached as a separate document) is the second output of this study. Building this very preliminary version of a catalog has enabled the team to assess the current situation of existing data and information of the study area for the purposes of this report. Within the same context, the Catalog of Data Sources itself is a rudimentary initiative – or one component of the initiative - of the recommended building of a common information base for the Red Sea region. As a sample it provides only a demonstration for the potentials of further expanded products and arrangements.

The Catalog of Data Sources is considered a preliminary survey of a selected sample of the existing data. It was not intended to present the actual data but only to give an idea about where to find data. Accordingly, it requires further expansion and updating to produce a comprehensive metadata reference that is easily accessed and used by different stakeholders. In advanced phases it could be published on the Internet allowing for linkage with the original data source and obtaining the actual data. The short-term objective of the proposed initiative is to expand, maintain, and update the catalog sustaining a standard suitable format that allows it to be used as a nucleus for a common and wider metadata reference (Annex 2).

While the long-term objective for any Catalog of Data Sources is to move towards internet accessibility there are yet other options – temporary or permanent – that could correspond to the very specific conditions and institutional set up of data and information generation, exchange, and use in Egypt. This section of the report identifies various options and steps for maintaining and updating the catalog.

As stated earlier, potential users comprise a wide scope list of decision-makers at various sector and levels of planning, monitoring, and management of environment and development. It includes the governmental sector, the private sector, consultant offices, research institutes, and students. Accordingly, two main factors have to be considered when choosing an option to maintain the catalog. The first factor involves the choice between maintaining the data by one institution versus multiple institutions. This factor requires considering resources, commitment, responsibilities, cooperation and coordination between various institutions. The second factor involves the mode of access to the data and whether it is adequate for all users or not.

6.2 Assessment of Alternative Dissemination Options

Creating and maintaining a hardcopy catalog of information resources related to economic development and natural resource protection of the Red Sea coast might be easy to produce and familiar to users. However, it is difficult to update and there is a need to replace and add pages for new entries and revisions of old entries in the copies of end users on a regular basis, or resorting to frequent re-publishing even with minor changes. This is not an efficient process for maintaining an up-to-date catalog.

Alternatives to a hardcopy catalog include production of a CD-ROM or Internet-based services. An important advantage of both these options is the ability to use computer searches to identify and sort information source. Information in the presented catalog is sorted by sectors. However, the digital metadata are expected to be retrieved through various paths (sector, geographic boundary, source, etc.). As digital records the entries can be simultaneously filed under an unlimited number of themes, thus greatly facilitating information searches. CD-ROM format still present the problem of regular updates.

Publishing the metadata information on the Internet is the long-term recommendation of this study. It is considered the most useful option for maintaining the information after it has been created. The information can then be linked to original data sources and databases. However, the format of the already created databases has to be taken into consideration when creating the metadata format. Transition to an Internet-accessible format can be made through a series of steps. Perhaps the first and simplest step is for institutions to use common library methods and metadata standards to give the public (or approved users), with Internet access, summaries of the institutions' information resources. The next step is to make selected documents and data sets downloadable via the Internet. Many institutions already do this when they create PDF documents from reports and place these on their Web site. This approach is useful for static data sets and documents and the technology for this step is a fairly simple one. The policy decision is sometimes more difficult.

The technology to access and search databases on-line is considerably more complicated, but still possible for most agencies. This approach allows users to access information in a periodically updated (synchronic) database. All or part of a database can be made accessible. For example, public Internet access to geo-referenced information about endangered species might be limited, whereas pictures and general descriptions of these species could be made available to the public. For examples of biodiversity databases on the Internet see WWW site of the Association for Biodiversity Information, their product "NatureServe," and links to the sites of their associates in the Network of Conservation Data Centers and Natural Heritage Programs. The on-line access to databases can be taken a step further by including GIS tools.

6.3 Assessment of Alternative Institutional Arrangements

Maintaining and updating the Catalog of Data Sources could be undertaken by a single institution or through the collaborative effort of a group of institutions. Each alternative has its merits and negative aspects. The following is an overall assessment of the various potential options.

Single institution

This requires one institution to prepare and update records for all data sources, as a proactive program to keep up with new and changing information sources. Advantages of maintaining the catalog from a single site are consistency of entries and very few personnel needed to be trained to maintain standard entries. However, the disadvantages are significant. A catalog produced by a

single institution will be skeletal at best and attempts to provide increasingly detailed metadata will likely result in increasingly inaccurate information.

Multiple institutions

This option has the advantage of distributing the responsibility for maintaining entries to the most qualified institutions. Under this scenario, whoever creates a data source would, in the ideal situation, create the catalog entry for their data source(s), presumably according to a standard agreed upon format. This has the advantage that those who know their data will do the best job of describing it, resulting in more detailed and accurate metadata. However, there are significant disadvantages to having scores of entities creating entries for a catalog. Each individual entity must acquire the expertise to use the metadata standards and apply them to their catalog entries. Those who receive training and support are mostly likely to get it right, though not always on the first attempt. Others without training will try and all too often create inaccurate or non-standard entries. And still others will not even attempt to create entries for their data sources, leaving gaps in the catalog. Still, a central node is required to provide training and quality control.

A variation of this option would involve a limited number of institutions, with each focused on managing the catalog entries for specific themes. For example, the Nature Protection Department might manage the entries for biological resources and protected areas. All sections of the catalog need not progress at the same pace. Themes can be added as willing sponsors are identified. As with the first option, these variations require a central unit to train people creating and updating records, to control the overall quality of the product and to manage the publication or dissemination process.

As the option of having digital format seems the most appropriate to facilitate expanded dissemination, selection between different options will be confined within "centralized" or "distributed" production. Table 7.1 summarizes the cons and pros of these two alternative options. Based on this discussion of the positive and negative aspects of the two options and considering the current institutional context, capacity potentials and limitations, etc., the option of centralized production appears as more fitting and implies less risky implementation.

Table 6.1 Options for Maintaining the Catalog

Option	Pros	Cons
Digital Format Centralized Production	• Easy for central staff to produce consistent entries • Digital formatted entries easy to search, making the product far more useful than a hardcopy report • Easy and inexpensive to update entire catalog periodically as CD-ROM version or continuously as Internet-accessible version • Internet version is always available to all potential users, even before they are aware of their needs – no need to identify users	• Difficult for central staff to understand content and produce adequate summaries of information of all types • CD-ROM version requires distribution of periodic updates • CD-ROM version requires that central staff produce and maintain mailing list of expected users • CD-ROM version – some potential users may not be identified and will not have the catalog • Internet version requires appropriate technology • Internet version requires that user understand and be familiar with Internet technology • Internet version requires publicity to make potential users aware that the product exists
Digital Format Distributed Production	• Entries produced by authoring institutions are potentially high quality • Digital formatted entries easy to search, making the product far more useful than a hardcopy report • Easy and inexpensive to update entire catalog periodically as CD-ROM version or continuously as Internet accessible version • Internet version is always available to all potential users, even before they are aware of their needs – no need to identify users	• Requires adoption of metadata standard by all participants • Requires that many people be trained to use standard metadata format • Some data producers may decline to participate so these sources potentially not represented in the catalog • Requires that central staff review the entries for quality assurance • CD-ROM version requires distribution of periodic updates • The CD-ROM version requires central staff produce and maintain mailing list of expected users • The CD-ROM version – some potential users may not be identified and will not have the catalog • Internet version requires appropriate technology • Internet version requires user understand and be familiar with Internet technology • Internet version requires publicity to make potential users aware that the product exists

Annex 1 List of Interviewees

Ahmed A Elseoud, Egyptian Project Manager, Environmental Information and Monitoring Programme, EEAA

Eng. Ahmed Abdel Aziz, Information and Decision Support Center, Tourism development Authority

Prof. Ahmed G. Abul-Azm, Head EIA Central Department, EEAA
Ali El Esseily, Director, HEPCA (NGO, Hurghada)

Amina Mohamed El Halwagy, General Manger, General Organization for Physical Planning

Prof. Alfy Morcos Fanos, National Water Research Center, Coastal Research Institute, Alexandria

Amr Ali, Dive Boat Owner and member HEPCA Board of Directors
Dr. Adel Rady, Head of TDA

Dr. Chris Howell, Program Manager, Red Sea Sustainable Tourism Initiative (RSSTI).

Prof. Elham A. Wassef, Director, National Institute of Oceanography and Fisheries, Alexandria

Frank Greif, Project Manager, Egyptian Environmental Information System / EEAA
Gisele Summer, SUBEX Dive Center, Movenpick Hotel, El Quseir

Dr. Hala N. Barakat, National Center for Documentation of Cultural and Natural Heritage, Ministry of Communication and information Technology

Dr. Hamdy I. El-Gamily, GIS Expert, National Authority for Remote Sensing and Space Sciences (NARSSS), and consultant to the Red Sea Governorate. (GIS) unit.

Dr. Hesham Mansour, Marine Ecologist, Department of Oceanography, University of Alexandria

Eng. Hussein El Gebaly Chairman, General Organization for Physical Planning

Mindy Baha El Din, Ornithologist, Independent Consultant

John McEachern, Director - EEPP Program Support Unit, Hurghada

Lee Fausak, Advisor – EEPP Program Support Unit, Hurghada

Dr. Mohamed Eisa, General Manager of Information Center, Egyptian Meteorological Authority

Mohamed Shaker, Manager of St. Katherine, Nature Protectorate

Dr. Mohamed Suddick El-Deek, National Institute of Oceanography and Fisheries, Prof. Marine Chemistry

Dr. Moussa Ibrahim Moussa, Manager of Central Department for Information and Computer Center, EEAA

Dr. Moustafa Fouda, Head of Central Department of Nature Protection, EEAA

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Annex 3 Metadata

Metadata sometimes sounds complicated and it can be. However, the basic concept is very simple. Perhaps its simplest form and the one familiar to most people is the card catalog in a library. Each index card in the catalog tells about a book, report, map, journal series or other item or collection in the library. For example, for a book it gives the title, author, year published, publisher, perhaps a summary and keywords, and it tells where in the library the book should be found. These are metadata about the book. One uses the card catalog – the metadata – to determine if the book will likely be useful for our purpose and if so, where it can be found.

Metadata are more complicated for geo-referenced information sources such as satellite images and maps derived from the satellite images, and synthesized digital products of these images describing the geology, vegetation, etc. One of the essential functions of metadata in today's digital age is to document the lineage (origins of the data sources) of information. Digital images can be combined and reconfigured and may be used to prepare derived products. The credibility of information sources usually requires that the lineage of the original data sources be precisely recorded. This sort of information is usually given as part of the map legend, which might say that the map was made from aerial photographs from a specific year and resolution. For digital maps and images there are no printed legends, so digital metadata records replace the legend as the source of information.

The metadata for databases and geo-referenced digital information requires one additional sort of information; instructions for how the data can be handled in a computer. This component of metadata is structured for computers to read, interpret and to potentially act on the data.

Extending metadata to Internet applications adds additional complexities, but also makes data and information far more accessible. If metadata are prepared using a standard format, including instructions for computer-to-computer data exchanges, then it becomes possible to use the Internet to combine datasets and images from different locations to do analysis and prepare unique products based on the most recent data from each source.

The *Metadata Primer* (http://www.lic.wisc.edu/metadata/metaprim.htm) adds this important function of metadata: "Metadata also insures that the data holdings of an agency are well documented and that agencies are not vulnerable to losing all the knowledge about their data when key employees retire or accept other jobs."

However complex metadata may seem, the principles are fairly simple. In all cases, the purpose of metadata is to provide information needed to determine if the item is likely to be useful for a given purpose, where it can be access, and how it can be used.

Much has been written about metadata over the past decade and competing formats have been proposed as standards. The International Standards Organization (ISO) is a proponent of metadata standards. (www.iso.org). One of the most widely used metadata standards are those developed by the U.S. Federal Geographic Data Committee (www.fgdc.gov). The FGDC metadata standards are thoroughly documented, supported by technical staff and training programs. The ISO and FGDC are currently working toward a common standard.

By adopting prevalent international standards for metadata, individual institutions can take advantage of existing documentation and training programs. The large user community, institutional stability, training programs and technical support, plus their convergence with the ISO international standard make the FGDC metadata a good choice for implementing metadata in Egypt or anywhere in the world. The EEAA Egyptian Environmental Information System uses the FGDC standards as the basis for their metadata.